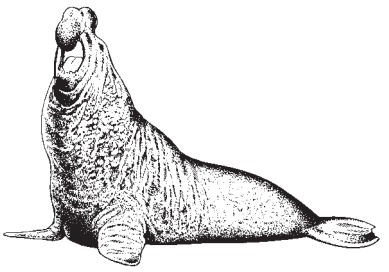
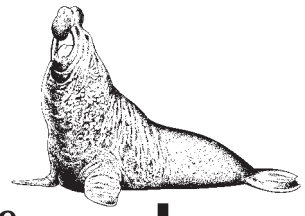
Creating
Coastal Stewardship
through Science



Discovering Northern Elephant Seals

Pre-Visit Activities

How Can I Learn about the Secret Lives of Elephant Seals?



Students receive an Elephant Seal Newspaper to complete three activity sheets focusing on northern elephant seal populations, behaviors, annual migrations, and relationships to humans. This overall introduction to elephant seal biology and ecology prepares students for the next two lessons and their field trip.

Time required: 2 hours

Location: classroom/ homework

Suggested group size: entire class

Subject(s): science, history, math

Concept(s) covered: population dynamics, human ecology, life cycles, biology, ethics

Written by: Erin Blackwood, The Marine Mammal Center
Trudie Behr-Scott, Hill Middle School

Last updated: 11/27/00

Student Outcomes

At the end of this activity, the students will be able to:

- Complete activity sheets based on their comprehension of the *Elephant Seals* newspaper.
- Understand how natural and human activities relate to elephant seal populations.
- Understand the role and importance of students and Point Reyes National Seashore in conserving northern elephant seals.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade: 5a- food webs
5b- organisms and the physical environment
5e- resources available and abiotic factors
7b- appropriate tools and technology to perform tests, collect data, and display data
7c- develop qualitative statements about the relationships between variables

7th grade: 2a- differences between the life cycles and reproduction of sexual and asexual organisms
3e- extinction of a species occurs when the environment changes and the adaptive characteristics for a species are insufficient for its survival
5a- animals have levels of organization for structure and function
5d- reproduction
7a- appropriate tools and technology to perform tests, collect data, and display data
7d- construct scale models and appropriately labeled diagrams to communicate scientific knowledge

8th grade: 9b- evaluate the accuracy and reproducibility of data.

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Think critically and logically to make the relationship between evidence and explanations; use mathematics in all aspects of scientific inquiry.
- Content Standard C – Structure and function in living systems; Reproduction and heredity; Regulation and behavior; Populations and ecosystems; Diversity and adaptations of organisms.
- Content Standard F – Science and technology in society.

Materials

To be photocopied from this guide:

- **Pre- and Post-Evaluation** activity sheets
- *Elephant Seals* newspaper
- **Vocabulary** sheets located in Teacher's Preparation/Attachments
- **Wild Wonders of the Deep** activity sheet
- **The Secret Lives of Elephant Seals** activity sheet
- **Worth versus Value** activity sheet

Vocabulary

Refer to vocabulary sheets located at the end of the Teacher's Preparation Unit.

Procedures

1. **Pre- and Post-Evaluation**
   Distribute Pre- and Post-Evaluation activity sheets. Remind students this is not a graded test, but rather a measure of our success; each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute in the first post-visit lesson. Students change their answers based on what they have learned.)

2. **Distribute newspaper**
   Students receive and read *Elephant Seals* newspaper. Students can work in pairs or individually to complete activities.

3. **Reading comprehension**
   Read the *Elephant Seals* newspaper as a class and clarify any questions or comments from students.

4. **Activity sheets**
   Give each student appropriate activity sheets, vocabulary list, and instructions for completion.

5. **Conclusions**
   Review students' answers, compare graphs, exchange ideas, and relate these concepts to lessons already covered earlier in the year.

Extension Ideas

1. Using charts and graphs in the *Elephant Seals* newspaper, have students speculate as to elephant seals' activity on their proposed field trip to Point Reyes National Seashore.

2. Discuss other pinnipeds found in California coastal waters: California sea lion, northern fur seal, Pacific harbor seal, Steller (northern) sea lion, Guadelupe fur seal. What are the identifying characteristics? How are they related to each other? Challenge students to create an evolutionary tree showing the five species above, or enlarge it to include other species such as the walrus.

Pre- and Post-Evaluation

Teacher Master

Vocabulary Match-Up

Draw connecting lines between words and their definitions.

Harem	Order of mammals including seals, sea lions, and walruses
Molt	Newborn elephant seal
Pinniped	Male elephant seal that has secured dominance over other male elephant seals for mating rights.
Proboscis	Shedding of skin layer and connected hair to make way for new skin and hair
Yearling	Group of females associated with one male for protection and reproduction
Weaner	A long, flexible snout characteristic of adult male elephant seals
Pup	An animal that is one-year-old, or one that has not completed its second year
Alpha Bull	Pup, under one year of age, that no longer relies on it's mothers milk

Elephant Seal History

Using the number 1–9, put these events in chronological order.

3 Mexican government bans elephant seal hunting

2 Fewer than 1,000 northern elephant seals remain

5 Worldwide population reaches an estimated 150,000 animals

1 British whale and seal hunters record seeing northern elephant seals from Baja, California to Mexico.

6 Elephant seals return to Point Reyes Headlands

4 United States bans elephant seal hunting

Species Challenges

Circle factors that have a negative impact on the survival of elephant seals even today.

Hunting

Storms

Habitat loss

Habitat protection

Proximity (nearness) of people to elephant seal colonies

Disease

Educating people about elephant seals

Scent left behind by dogs

Pre- and Post- Evaluation

(continued)

Teacher Master

Life Cycle Information — True or False?

T (F) Elephant seals spend only 20% of their lives at sea.

T (F) Elephant seal pups can swim as soon as they are born.

(T) F Elephant seals haul out on land to molt, to mate, and to give birth.

(T) F Male elephant seals will battle to gain a position as the top bull, or alpha.

National Park System

In your own words, describe the mission of the National Park Service.

answers will vary

Stewardship

What can you do to help elephant seals? List your ideas on the back of this paper.

answers will vary

Name _____ Date _____

Activity Sheet

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Pre and Post Evaluation

(continued)

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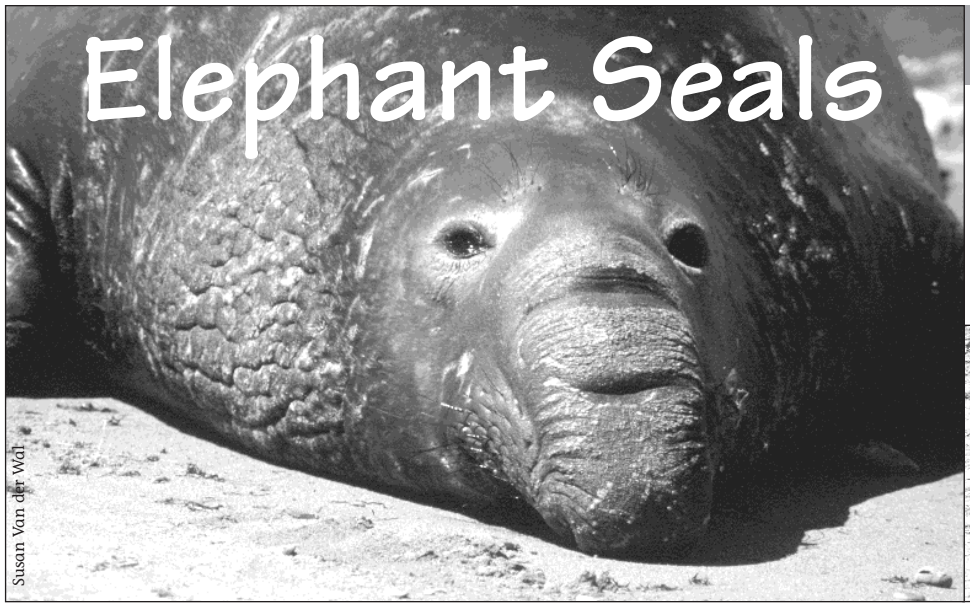
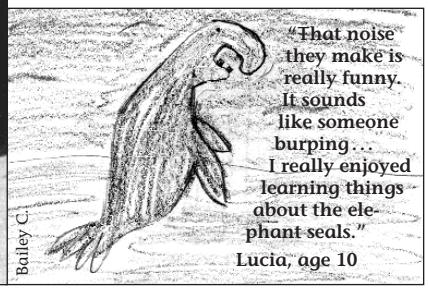
Elephant Seals



Susan Van der Wal

Inside:



Bailey C.

"That noise they make is really funny. It sounds like someone burping… I really enjoyed learning things about the elephant seals."
Lucia, age 10

Wild Wonders of the Deep

Point Reyes National Seashore is one of the few places in California where you can see North America's largest seal, the northern elephant seal. On shore for only a few months each year, these large but elusive creatures are often heard before they are seen. They are very social on land yet live a solitary existence at sea. This is the story of a remarkable species, living a life of extremes.

A Close Call with Extinction

While exploring the Pacific Coast in the 1800s, a British whale and seal hunter named Charles Scammon saw northern elephant seals from Baja California in Mexico, to Point Reyes, California, north of San Francisco. Elephant seals currently range from Mexico to Alaska and spend 80 percent of their life in the open sea. Sharing the fate of many of the oceans' great whales, they were hunted to the brink of extinction for their oil-rich blubber. One bull elephant seal would yield nearly 25 gallons of oil. Though we don't know exactly how many northern elephant seals were alive before the twentieth century, it has been estimated that fewer than 1,000 existed by 1910. The Mexican government banned elephant seal hunting in 1922, followed shortly by the United States government. Since then, the population of northern elephant seals has recovered at an average annual rate of 6 percent. Today, thanks to government protection and the seals' distant lives at sea, the worldwide population has grown to an estimated 150,000 animals.

Elephant seals exemplify the remarkable recovery of a near-extinct species.

After being absent for more than 150 years, elephant seals returned to Point Reyes Headlands in the early 1970s. In 1981, the first breeding pair was discovered near Chimney Rock. Since then, researchers have found that the colony is growing at a dramatic annual average rate of 16 percent. When severe storms occurred in 1992, 1994, and 1998, many pups were killed. During the El Niño winter of 1998, storms and high tides washed away approximately 85% of the 350 young pups before they had learned to swim. Nevertheless, the Point Reyes winter population of elephant seals is between 1,500 and 2,000. Fanning out from their initial secluded spot, the seals' expansion to popular beaches is causing concern for both their safety and that of their human visitors.

Proximity of People and Pets Raises Concern

A beach full of lumbering and slumbering seals is a rare and spectacular sight. Some people feel compelled to get "just a little closer". Unlike other seals and sea lions that react by stampeding into the water when disturbed, elephant seals do not always retreat from humans. Instead they may react by fighting with each other or moving to another section of beach. An ill-timed move could crush a pup or separate a female from her pup, creating a possible life-or-death situation for the young elephant seal. Human presence especially frightens pregnant females and new mothers, discouraging them from returning the next year. When surprised or approached too closely, elephant seals will also chase or bite people. Any change in elephant seal behavior caused by a person is, by definition, a violation of the Marine Mammal Protection Act. If you are less than 100 feet from an elephant seal, you are too close.

Dogs pose a safety concern to elephant seals. Predatory behavior and possible disease transmission (from dogs to seals, or vice versa!) could create serious problems for either animal. A dog's scent can frighten and disturb seals. Even on a leash, a dog may threaten seals by barking or cause injury by biting. Some beaches in the Park will temporarily be closed to dogs as the beaches become inhabited by breeding elephant seals.

Kim Linse

Leashed dogs are welcome on South Limantour, North, South, and Kehoe Beaches when wildlife restrictions are not in place. Please inquire at the Visitor Centers about pet restrictions and watch for closure signs.

Competition for Habitat

Sensitive resources such as birds and plants are also affected by elephant seals. The western snowy plover, a federally-threatened species under the Endangered Species Act, breeds on few California beaches. Loss of habitat to beachfront development and human recreation has forced elephant seals and plovers to compete for limited protected space. Also, rare plants native to coastal dunes are potentially at risk. Elephant seals and their curious

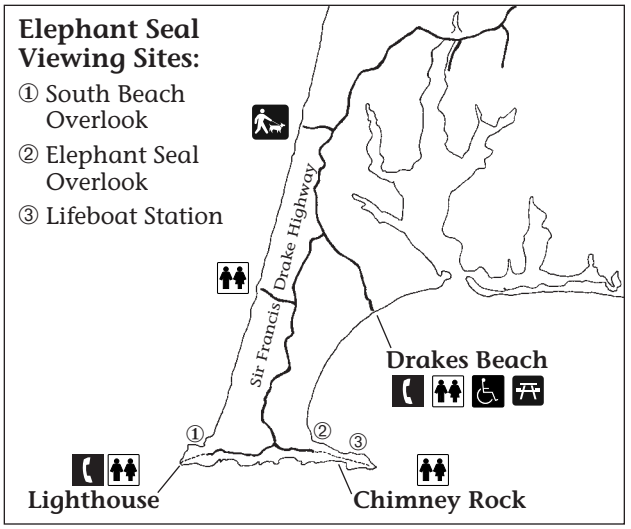
(please see page 2)

(continued from page 1)

human visitors may physically crush plants that are struggling to remain alive.

The Park's task is to balance the expansion of the elephant seal colony while providing for the health of other species. To manage this balance, the Park will continue its docent program, which provides visitors with on-site information and safety messages at the overlooks. To anticipate where the elephant seals might expand to next, researchers will attempt to discover why seals prefer to breed on some beaches and not others. This information will allow the Park to make informed choices about appropriate beach use by people, pets, and wildlife.

Biologists monitor seal behavior.



At Sea

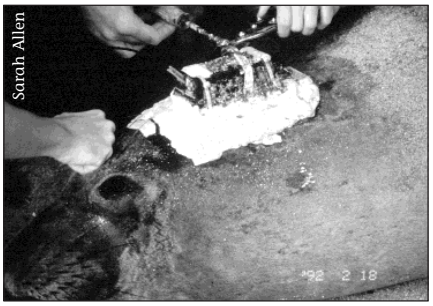
The Secret Lives of Elephant Seals

Northern elephant seals are mysterious and unique creatures. Not only do they spend most of their life in the ocean, but 90 percent of that time is spent underwater: eating, sleeping, digesting, and traveling. They are built to survive continuous dives to depths that would squeeze the life out of any other mammal. The average dive reaches 2,000 feet, lasts close to half an hour and is followed by only 3 to 5 minutes at the surface to breathe. Imagine being able to live in such extremes!

The deepest dive on record is over 5,000 feet and the longest dive is 2 hours!

Why do they dive so deep? The oceans are full of food for millions of animals, but relatively few feed at the depths elephant seals prefer. As a result, they face little competition for food. Feeding in almost total darkness, elephant seals use their large eyes and the bioluminescence of some prey, such as octopus and squid, to find food where other predators would not even be able to see. They may use their stiff yet sensitive 3- to 8-inch whiskers to "feel" some food, such as Pacific hake, skates, rays, shrimp, small sharks and crabs.

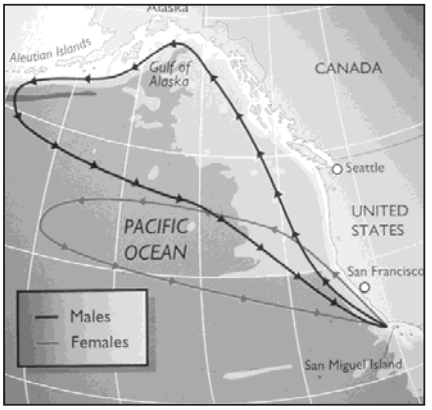
What allows such deep diving? Pressure increases as any object goes deeper into the ocean. As animals dive, the pressure on the outside compresses the air in their bodies. Elephant seals differ from humans in that when they dive, they carry all the oxygen they need in their blood rather than in their lungs. Before they dive, elephant seals exhale, collapsing their lungs so there is little air to be compressed. As they dive, the seals' fat is also compressed so that the animals lose buoyancy and sink, allowing the seals to achieve great depth with little effort.



Electronic devices (time depth recorders) attached to elephant seals measure the depth and duration of dives, the amount of time spent resting at the surface between dives, and the sequential patterns of dives.

Elephant seals prolong their dives by reducing their heart rates. A seal resting on land has a heart rate of 55 to 120 beats per minute, but when diving, the heart slows to 4 to 15 beats per minute. The seal maintains normal blood pressure by decreasing the blood supply to its extremities, allowing the blood to flow primarily to the vital organs and the brain. This also helps the seal conserve body heat when down in the cold ocean depths.

During semiannual migrations, adult males and females not only travel thousands of miles apart, but also tend to have different feeding patterns. Males tend to return to the same feeding areas off the Aleutian Islands each year, while females tend to feed in the northeast Pacific and near Hawaii. To complete their two annual round-trips, females journey over 11,000 miles, males 13,000 miles. Males dive deeply and repeatedly for food. After about 3 weeks, they have eaten so much that their dive pattern changes to a flat-bottom dive, following the bottom contours as they rest and digest. Females also dive deeply and repeatedly, but they go deeper during the daytime than at night.



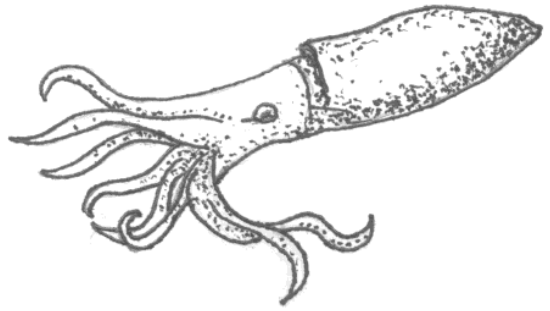
Northern elephant seals journey between their feeding grounds and land twice each year. They return to land in winter to breed and in spring/summer to molt (shed).

Although their locations and diving patterns differ, both sexes dive repeatedly for 4 to 5 months during summer and fall. Research suggests that elephant seals forage continuously during their migrations and, furthermore, they don't sleep! They may take underwater "catnaps" when they dive, as their heart rate slows, making only brief, infrequent surface appearances. This pattern, and the incredible amount of time spent below the surface, explains why so few of them have been seen in the open ocean despite their rapidly growing population.

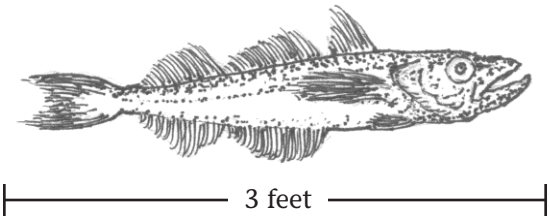
Point Reyes National Seashore is one of the few places on the Pacific Coast where northern elephant seals can be observed and studied on shore. Their semiannual sojourns to the shores of Point Reyes provide a unique opportunity to glimpse the lives and behaviors of these elusive ocean giants. Visit the Elephant Seal Overlook near Chimney Rock and discover for yourself the secrets of these wild wonders of the deep!

What Do Elephant Seals Eat?

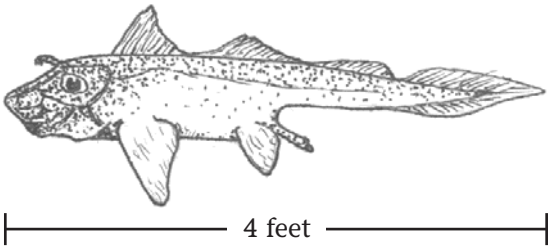
While elephant seals are at sea, they need to store enough energy to sustain themselves when they haul out to give birth and mate in the winter and again in the summer when they molt. But how do you find out what an elephant seal eats at sea when it dives to depths of up to 5,000 feet? By looking at the stomach contents of elephant seals that have died, scientists have found that seals have a varied food source with their favorite or most common food being squid that can be up to 6 feet long.



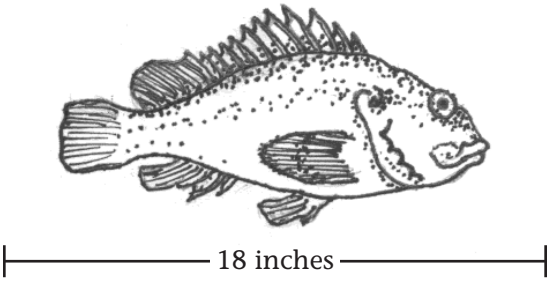
Squid are the most frequently consumed prey of the northern elephant seal. They live far offshore in deep water and are found in large groups. This grouping occurs during the breeding cycle and also when following large schools of prey.



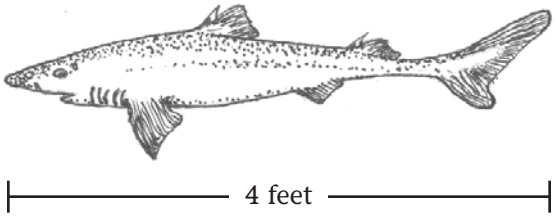
Pacific hake range from northern Alaska to Magdalena Bay in California, and are found at depths of 183 to 914 meters. They are schooling fish migrating vertically each day (feeding nearer to the surface as night approaches), and offshore in the winter. It feeds mainly on fishes, but also on squid and crustaceans.



Ratfish are found mainly in the cooler regions of the Atlantic, Pacific and Indian Oceans. They are long-bodied fish, sharklike in many respects, with a long dorsal spine that is connected to a venom gland. They are very abundant and are found at depths of 92 to 913 meters.



Rockfish belong to the family of redfishes and scorpion fishes, and are found worldwide, except in the Antarctic region. They are abundant fish living at depths of 73 to 640 meters, and are important commercial species, as well as an important prey of halibut and albacore. Average length is 18 inches.



Dogfish have a sharp spine in front of the dorsal fin which can inflict serious wounds made worse by the venom that is injected. These sharks are found worldwide in inshore waters at depths up to 950 meters.

On Land

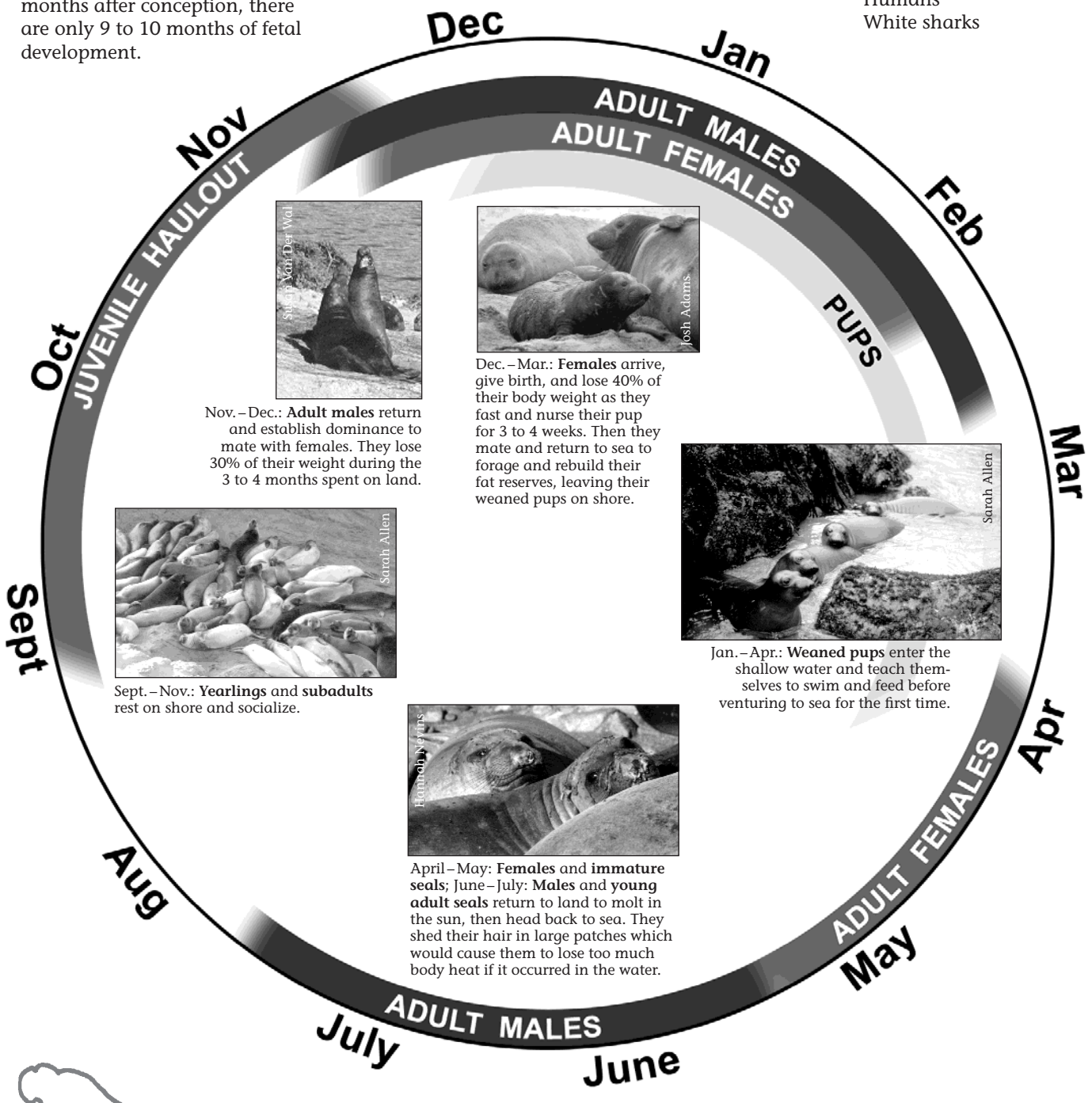
Northern elephant seals can be seen on land at Point Reyes National Seashore for a few months each year. During the rest of the year, elephant seals live only in the ocean.

Delayed Implantation

Although pups are born 12 months after conception, there are only 9 to 10 months of fetal development.

Predators

Orcas
Humans
White sharks



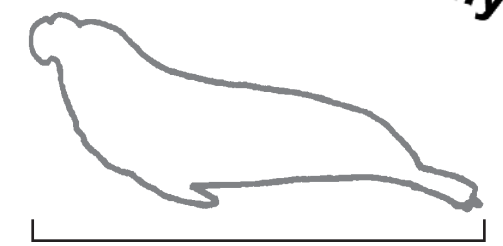
Nov.–Dec.: **Adult males** return and establish dominance to mate with females. They lose 30% of their weight during the 3 to 4 months spent on land.

Dec.–Mar.: **Females** arrive, give birth, and lose 40% of their body weight as they fast and nurse their pup for 3 to 4 weeks. Then they mate and return to sea to forage and rebuild their fat reserves, leaving their weaned pups on shore.

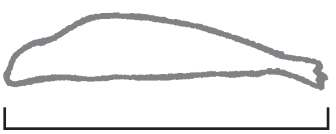
Jan.–Apr.: **Weaned pups** enter the shallow water and teach themselves to swim and feed before venturing to sea for the first time.

Sept.–Nov.: **Yearlings** and **subadults** rest on shore and socialize.

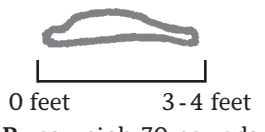
April–May: **Females** and **immature seals**; June–July: **Males** and **young adult seals** return to land to molt in the sun, then head back to sea. They shed their hair in large patches which would cause them to lose too much body heat if it occurred in the water.



Bulls weigh 3,000-5,000 pounds.



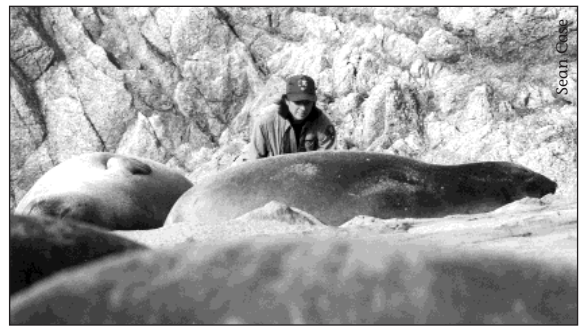
Cows weigh 800-1,200 pounds.



Pups weigh 70 pounds at birth. When weaned at 4 weeks, they weigh nearly 300 pounds.

Elephant Seal Monitoring

Have you ever wondered how scientist learn about animals as unusual as elephant seals? By monitoring elephant seals at Point Reyes researchers and scientists determine trends in seal populations, migration, and reproductive success. This data is used as a baseline to determine trends, quantify annual reproductive success, and learn about their biology.


Sean Gee

When Does the Monitoring Happen?
Elephant seals arrive at Point Reyes in December through March during the breeding season and again during May through July, as seals return to Point Reyes to molt (shed and regrow their entire fur coat).

Where Does the Monitoring Happen?
The monitoring occurs in all the elephant seal colonies found on the Point Reyes Headlands including the colony that you will visit at Chimney Rock.

What Are the Methods?
Researchers visit elephant seal colonies regularly during the pupping and mating season. They count seal numbers, births, deaths, and document unusual behavior. Listed below are other methods that researchers use to determine biology and to track individual animals.

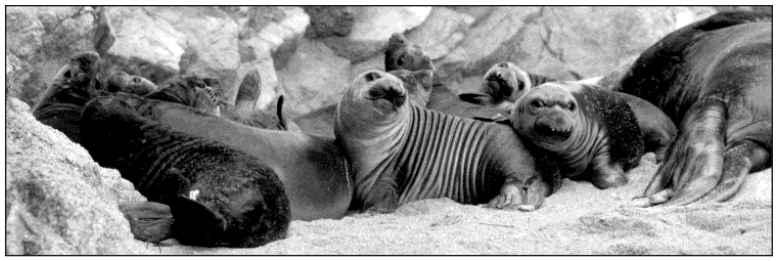
Flipper Tags
These tags are made of colored plastic. The color of tags used by researchers can let you know the geographic location where the animal was tagged. Marine mammal rehabilitation hospitals, like The Marine Mammal Center, tag their rehabilitated patients that are released back to the wild with orange tags only. Sea lions are tagged on their front flippers. Seals are tagged in the webbing between digits on their hind flippers.

Brands
Researchers will tag and permanently brand numbers on the animal's back or side in an effort to track the animal during its entire life. Tags are not as reliable as a brand. Tags may fall off, or the numbers may rub off. Tags are harder to see. The continued observation of branded individuals can provide a wealth of information about range, behavior, and life history of not only that individual but the entire species. The numbers are put on with either a hot brand or a cold brand. A hot brand is done with a heated metal number. The cold brand is a copper number chilled with liquid nitrogen. With both procedures the animal must be held still—not an easy task. The hot brand takes seconds to leave a mark, while the cold brand may take a minute or more. Hot brands are easier to apply, but they kill the fur follicles and cause deep damage if done carelessly. Cold brands are not as damaging. The fur grows back white in color, so the number is visible.

Dye Marks
Numbers, names, or identifying marks are sometimes dyed into the fur of seals and sea lions. Regular hair dye, donated by a company or by Lady Clairol TM, is used. Dye marks are only temporary as they disappear when the animal molts.

Time Depth Recorders, Radio Tags and Satellite Tags
Time depth recorders (TDRs) are set in a white plasterlike base and are glued with epoxy to the seal's back. These are convenient to use with elephant seals that return to the same location on land when they molt, so the TDR can be easily retrieved. The information gathered by a TDR is transferred to a computer for analysis. TDRs are activated by sensing light and dark. TDR data enable scientists to see how often the animal dives, and the depth and duration of the dive. Researchers have also used TDRs with harbor seals.

Radio tags and satellite tags have a small transmitter and battery encased in epoxy. The antenna can be internal or protrude. The tags may be attached to a flipper or glued to the head or back with super glue. Each radio tag has a specific radio frequency. The signal is detected using a handheld receiver.



Seal Viewing Tips

- ❑ For your own safety, always observe elephant seals from a distance. Use binoculars and spotting scopes. If a seal becomes alert or nervous and begins to move away, you are too close.
- ❑ Stay at least 100 feet from any marine mammal.
- ❑ Do not come between a cow and pup, a bull and a group of cows, or two bulls challenging each other.
- ❑ Watch quietly; whisper. Move slowly.
- ❑ Bring your pets only where they are allowed.
- ❑ Observe beach closures and restrictions.


Susan Van Der Wal

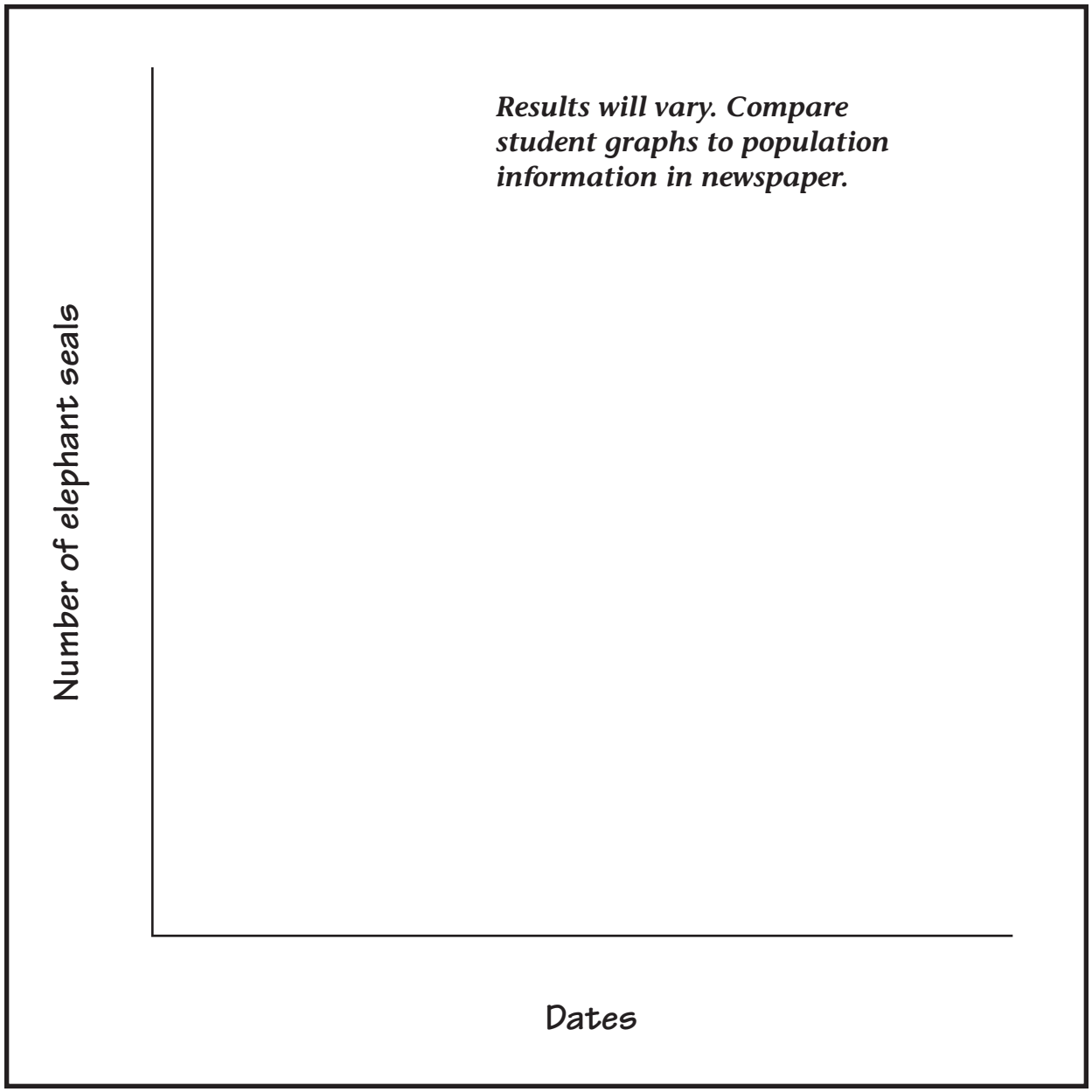
Special Thanks

Special thanks for support and contributions:

Point Reyes National Seashore Association
Gulf of the Farallones National Marine Sanctuary
Año Nuevo State Reserve
Marine Mammal Center
Canon, USA, Inc. "Expeditions in the Park"
National Park Foundation

1. **Using the newspaper, make a list of any relevant information on dates and corresponding population numbers of elephant seals.**

2. **Graph your information below using a line graph or a bar graph.**



Results will vary. Compare student graphs to population information in newspaper.

Activity Master

3. **Think about the following questions and record your thoughts.**
   a. Why was the population so low in 1910?
   ANSWER: *Overhunting by humans for their oil-rich blubber.*

   b. Why did the population increase so dramatically?
   ANSWER: *Mexico and the United States banned hunting.*

   c. Elephant seals are protected from hunting today, but what other threats exist for them? Can anything be done to prevent some of these threats?
   ANSWER: *Expanded use of elephant seal pupping/breeding beaches by people and their pets pose a serious threat.* ***Prevention:*** *people and their pets can use other beaches when elephant seals are present. Expanded hunting of elephant seals by other countries is a potential threat.* ***Prevention:*** *Develop lobbying groups to create political support for international hunting bans and work to educate other countries about oil options.*

4. **What do you think will happen to the populations of elephant seals in the next 10 years? Why?**
   ANSWER: *Answers may vary. Elephant seal populations are likely to grow if people choose to limit their use of elephant seal haul out areas. If people do not keep sandy, protected beaches available to the elephant seals, then populations will drop unless they are able to relocate.*

Migration Patterns

1. How many times do elephant seals journey between their feeding grounds and land each year?
   ANSWER: *Twice—once to give birth/mate and once to molt.*

2. Why do they haul out on land?
   ANSWER: *To give birth, mate and molt*

3. Where do males travel? Females?
   ANSWER: *Males travel between California and Alaska; females travel between California and Hawaii.*

4. How do adult travel patterns differ from the activities of a yearling seal?
   ANSWER: *Yearling seals rest on shore and socialize from September to November. They may not make the complete trip to the feeding grounds like the adults.*

Underwater World

An elephant seal will repeatedly spend 30 minutes underwater and 3 minutes at the surface. Use the activity below to help you determine how much time these mighty ocean dwellers spend both underwater and at the surface during a 24-hour period.

underwater minutes = __30 min.__ **surface minutes** = __3 min.__

a = 1 hour = __60__ minutes

b = (24 hours × a) = __1440__ minutes in one day

c = **(underwater minutes + surface minutes)** = __33__ minutes for one cycle

d = **(b ÷ c)** = __44 (average)__ cycles of underwater/surface activity

e = **(d × underwater minutes)** = __1320__ total underwater minutes in 24 hours

f = **(d × surface minutes)** = __132__ total surface minutes in 24 hours

ANSWER: __22__ hours underwater in 24 hours
__2.2__ hours at the surface in 24 hours

Activity Master

Elephant Seal Newspaper Activity

Worth Versus Value

Worth is the the quality of something that makes it desirable, useful, or valuable. ***Value*** is an amount considered to be an equal exchange for something else. When considereing issues of preservation and conservation, these two terms are critical because they often guide decision making. In our modern society natural resources, such as elephant seals, are often viewed only in terms of their economic worth or value. However, new ways of thinking challenge us to recognize the worth and value of natural resources not so much for monetary rewards but for the worth and value that they hold just existing in the natural environment.

Think about how the concepts of worth and value relate to elephant seals and answer the following questions.

1. **What is the value of an elephant seal?**
   ANSWERS will vary. *Values can be defined as economic, scientific, cultural, ecological, humanistic, intrinsic . . .*

2. **What have been the economic uses of elephant seals in the past?**
   ANSWER: *Blubber for oil; scientific collections/study specimens.*

3. **List three benefits and three consequences of oil use.**

BENEFITS	**CONSEQUENCES**
1) *Lubrication between metal parts*	1) *Pollution (land and marine)*
2) *Creates jobs*	2) *Environmental degradation*
3) *Income source for some countries*	3) *Continued use of oil insures depletion of nonrenewable resources (elephant seals)*

4. **Are there other alternatives?**
   ANSWERS will vary: *use recycled oil; reduce use of oil with alternative transportation methods; support alternative fuels and research for alternatives; synthetic oil or vegetable oils*

5. **Why are elephant seals in Point Reyes protected by the National Park Service? Is protection in Point Reyes National Seashore enough?**
   ANSWERS will vary. *The National Park Service exists to protect natural resources, such as elephant seals, and their habitats for their value and their worth.* ***NO.*** *Protection within National Park Service areas is not enough. Elephant seals travel and hunt outside of National Parks, thus they are affected by people in many places. Their ocean habitat, food sources, and beach habitats must be protected to insure their survival. They rely on adequate space and shelter, clean air and water, and adequate food — just like we do. The entire environment must be protected to insure their survival and ours.*

6. **How does this message from the National Park Service apply to elephant seals?**

A Message from the National Park Service:

The National Park Service cares for special places saved by the American people so that all may experience our heritage

ANSWERS will vary. *The National Park Service provides the species with a protected habitat within National Park Service areas. It encourages research on the species and the education of people so that they understand and value the existence of the species. The National Park Service promotes stewardship of elephant seals— encouraging people to make choices and take actions that will insure the survival of the species so they can be enjoyed by future generations.*

Name _____ **Date** _____

Elephant Seal Newspaper Activity

Wild Wonders of the Deep

Activity Sheet

1. **Using the newspaper, make a list of any relevant information on dates and corresponding population numbers of elephant seals.**

2. **Graph your information below using a line graph or a bar graph.**

Number of elephant seals

Dates

Activity Sheet

Name _____ **Date** _____

Elephant Seal Newspaper Activity

Wild Wonders of the Deep

(continued)

3. Think about the following questions and record your thoughts.

a. Why was the population so low in 1910?

b. Why did the population increase so dramatically?

c. Elephant seals are protected from hunting today, but what other threats exist for them? Can anything be done to prevent some of these threats?

THREATS **PREVENTION**

4. What do you think will happen to the populations of elephant seals in the next 10 years? Why?

Name _____ **Date** _____

Activity Sheet

Elephant Seal Newspaper Activity

The Secret Lives of Elephant Seals: at Sea, on Land

Migration Patterns

1. How many times do elephant seals journey between their feeding grounds and land each year?

2. Why do they haul out on land?

3. Where do males travel? Females?

4. How do adult travel patterns differ from the activities of a yearling seal?

Underwater World

An elephant seal will repeatedly spend 30 minutes underwater and 3 minutes at the surface. Use the activity below to help you determine how much time these mighty ocean dwellers spend both underwater and at the surface during a 24-hour period.

underwater minutes = _____ **surface minutes** = _____

a = 1 hour = _____ minutes

b = (24 hours × a) = _____ minutes in one day

c = (**underwater minutes + surface minutes**) = _____ minutes for one cycle

d = (**b ÷ c**) = _____ cycles of underwater / surface activity

e = (**d × underwater minutes**) = _____ total underwater minutes in 24 hours

f = (**d × surface minutes**) = _____ total surface minutes in 24 hours

ANSWER: _____ hours underwater in 24 hours

_____ hours at the surface in 24 hours

Activity Sheet

Name _____ **Date** _____

Elephant Seal Newspaper Activity

Worth Versus Value

Worth is the the quality of something that makes it desirable, useful, or valuable. ***Value*** is an amount considered to be an equal exchange for something else. When considereing issues of preservation and conservation, these two words are critical because they often guide decision making. In our modern society natural resources, such as elephant seals, are often viewed only in terms of their econimic worth or value. However, new ways of thinking challenge us to recognize the worth and value of natural resources not so much for monetary rewards but for the worth and value that they hold just existing in the natural environment.

Think about how the concepts of worth and value relate to elephant seals and answer the following questions.

1. What is the value of an elephant seal?

2. What have been the economic uses of elephant seals in the past?

3. List three benefits and three consequences of oil use.

BENEFITS	CONSEQUENCES
1)	1)
2)	2)
3)	3)

4. Are there other alternatives?

Name _____ Date _____

Elephant Seal Newspaper Activity

Worth versus Value

(continued)

Activity Sheet

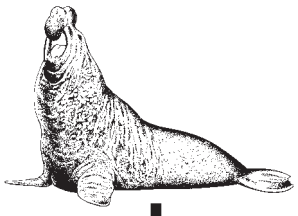
5. **Why are Elephant Seals in Point Reyes protected by the National Park Service? Is protection in Point Reyes National Seashore enough?**

6. **How does this message from the National Park Service apply to Elephant Seals?**

A Message from the National Park Service:

The National Park Service cares for special places saved by the American people so that all may experience our heritage

How Are Elephant Seals Adapted to Their Environment?



Students create posters or skits based on specific adaptive characteristics of elephant seals. Most of these adaptations will be observable on the field trip.

Time required: 2 hours

Location: classroom

Suggested group size: 30 students, divided into teams

Subject(s): science

Concept(s) covered: adaptation: biological water conservation, fasting, waste removal, thermoregulation, delayed implantation, diving mammals, secondary sexual traits, etc.

Adapted from: MARE: Marine Activities, Resources and Education, Regents of the University of California

Written by: Trudie Behr-Scott, Hill Middle School
Leila Raim, Volunteer, Point Reyes National Seashore

Last updated: 11/27/00

Student Outcomes

At the end of this activity, the students will be able to:

- Produce a poster outlining one specific elephant seal adaptation.
- Lay a foundation for elephant seal behaviors to be observed on field trip.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade 5c- organisms can be categorized by functions
5e- resources available and abiotic factors

7th grade 5a- animals have levels of organization for structure and function
5c- bones and muscles work together to provide a framework for movement
5d- reproduction

Pre-Visit Lesson Plan

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following area:

- Content Standard C – Structure and function in living systems; regulation and behavior; diversity and adaptations of organisms

Materials

To be provided by the teacher:

- Poster paper, scissors, drawing supplies

To be photocopied from this guide:

- **Adaptation Note Taking Guide** activity sheet (one per student)
- **Elephant Seal Adaptation Cards** activity sheet (one per class)

Vocabulary

Adaptation, blubber, conservation, delayed implantation, fetus, gestation, metabolism, proboscis, toxin

Procedures

1. **Introduce concept of adaptation**
   Lead a discussion of adaptations. What are some examples of adaptations for humans, cats, dogs, or other types of mammals?
2. **Form teams**
   Divide students into teams so that each Elephant Seal Adaptation Card (15 total) has students responsible for making a poster. Each student team will receive an adaptation card, a note-taking guide, and poster paper. Each team will produce a poster highlighting their particular adaptation.

   Group that receives "Thermoregulation: Size Matters" as an adaptation will produce life-sized silhouettes of elephant seals instead of a poster. Silhouettes of a female and pup can be drawn inside a male silhouette or on a separate piece of paper. Use a grid method to transfer drawing (1" = 3 to 4 feet) or project the images onto paper using an overhead projector. Students can trace the image at an appropriate size.

   Group that receives **Vocalizations** as an adaptation will need to visit a website and share sounds with other students. ***http://www.parks.ca.gov/central/bayarea/an228/an228m.htm*** Keyword: elephant seals and sounds
3. **Display posters**
   Hang posters where they will get attention and teach others about elephant seals. Try a parent open house or the auditorium. Use the "Size Matters" adaptation posters as a safety message instructing students to remain at a distance from elephant seals.
4. **Optional skit activity**
   Students working in teams will receive an adaptation card and be instructed to portray their adaptation using theatrics and drama. Other students will guess what is being portrayed.

Extension ideas

1. Have students design and draw animals suited to live in a cold, dark environment under great oceanic pressure. What adaptations help your animals cope with physical conditions of the deep sea? How do they find food, avoid being eaten, reproduce, and communicate with one another?
   (source: *Sea Searcher's Handbook:* Monterey Bay Aquarium)
2. Explain how natural selection favors animals that have adapted to their environment. Imagine an elephant seal that evolved to live in a different environment. What would that elephant seal look like? What would it eat? How would it defend itself? Would an elephant seal need its blubber if it lived in the desert? What adaptations would it need to live in outer space? Choose a different environment (forest, marsh, city, etc.) and draw an elephant seal in that new environment. Create new body parts that it will need to survive in its new home. Label the parts.
3. Have students create adaptations for an organism facing challenges in its environment (western snowy plovers, red-legged frogs, and native grasses).
4. Discuss evolution of marine mammals from land mammals. Why would land mammals return to a marine environment?

Name _____ Date _____

Adaptation Note-taking Guide

Activity Sheet

Read your Elephant Seal Adaptation Card and list all of the ideas that you would like to include on your poster below:

Questions that I still have or things that I want to know more about:

Name _____ Date _____

Activity Sheet

Elephant Seal Adaptation Cards

A

Elephant Seal Adaptation:

Fasting

Adult male elephant seals do not eat for up to 3 months while they are on land trying to establish and maintain dominance over other males. If they were to leave their harem, other males might mate with the females. Female elephant seals fast for a month while they give birth, nurse their pups, and mate. Weaners will fast for 1 to 2 months after weaning. This is an advantage because it postpones the time they need to search for food until they have learned to swim.

B

Elephant Seal Adaptation:

Concentrated Urine

Animals need to flush out wastes that are formed by digesting food for energy. One type of waste formed through digestion is urine. Urine helps to flush out toxins and excess water. Elephant seals have large and powerful kidneys, an adaptation that concentrates large amounts of toxins into a small amount of urine. This helps them to save precious water all the time, but especially while fasting. Elephant seal urine is thick and brightly colored.

C

Elephant Seal Adaptation:

Energy from Fat

In adult males, blubber may account for nearly 50 percent of an adult male's weight at the beginning of the breeding season. By the end of breeding season adult elephant seals (of both sexes) lose about one-third of their weight. Blubber is an adaptation for animals that fast. When they are fasting, elephant seals use their blubber as stored energy. As they use their blubber for "food" a chemical by-product of their metabolism is water. This is how they can produce enough energy and water while fasting.

Name _____ Date _____

Elephant Seal Adaptation Cards

Activity Sheet

D

Elephant Seal Adaptation:

Thermoregulation: Keep Cool, Stay Warm

Elephant seals have "shunts" in their circulatory systems. A shunt acts like a valve, diverting blood flow in one direction or another. When in the water, they shunt blood away from their body surface in order to keep their core and vital organs warm. When on land, they cool off by sleeping with a front flipper raised straight up in the air. They shunt blood to the surface and heat is "dumped" into the air. Blubber helps them stay warm in cold water. It insulates like a wetsuit. Imagine that a human wetsuit is a quarter-inch thick, and an elephant seal blubber layer may be 6 inches thick. So much blubber makes it hard to stay cool on land. Sometimes elephant seals sleep in tidepools or rain puddles. This is a good adaptation for staying cool and losing less water to evaporation. Elephant seals also flip cold, damp sand on their backs to reflect the sun away and stay cool.

E

Elephant Seal Adaptation:

Chest Shields

As a secondary sex trait (like a man's beard), male elephant seals develop a hard chest shield of thickened skin and scar tissue. It begins to develop when the animal is about 2 to 3 years old. By the time the male is a fully developed bull, about 8 to 9 years old, the shield covers most of the chest. It grows up to slightly above the level of the male's eyes, almost forming a type of "necklace." The chest shield protects them from major injuries during fights with other males.

F

Elephant Seal Adaptation:

Big Noses/ Proboscis

As a secondary sex trait (like a man's deepening voice), male elephant seals develop a large bulblike snout known as a proboscis. Females and young males are very hard to tell apart. But when a male is about 2 years old, and the nose starts to grow, they can easily be distinguished. By the time a male reaches sexual maturity, at about 4 years, its nose may be a foot long. A fully developed bull, age 8 or 9 years old, may have a nose 2 feet long. The size of the snout and the loudness of the vocal threat will often discourage a challenge and allow a male to save energy by avoiding actual battles.

Name _____ Date _____

Elephant Seal Adaptation Cards

Activity Sheet

G

Elephant Seal Adaptation:

Delayed Implantation

Most adult female elephant seals mate and have a pup each winter. A pup is born 11 months after its mother mates. But a female elephant seal does not become pregnant immediately after mating. Fetal development stalls for 2 to 3 months; then the embryo implants on the wall of the uterus and the active gestation period of 8 to 9 months begins. Delayed implantation allows the pregnant female to build her strength back up (after fasting) before the new fetus begins to develop. This adaptation also makes it possible for birthing and mating to occur close together while large numbers of mature animals are on the same beach.

H

Elephant Seal Adaptation:

Female Choice in Mates

Female elephant seals have some choice in deciding with which male they will mate. If they are not ready to mate they protest, resist, and try to escape. When approached by a male other than the dominant bull, the female will usually protest loudly to alert the dominant bull of the other male's presence. These behavioral adaptations enable the biggest, strongest males to mate with females. Sometimes, however, less dominant males do succeed in mating with a receptive female, and often females mate with nondominant males as they leave the colony.

I

Elephant Seal Adaptation:

Deep Continuous Diving at Sea

Elephant seals dive deeper and longer and more often than any other marine mammal. The average adult dive is about 1,500 feet, but they often dive over 5,000 feet deep (about a mile)! They stay down an average of 22 minutes but may remain underwater for more than 90 minutes. They spend 3 to 5 minutes resting at the surface and then dive again. They do this continuously, spending 85 to 90 percent of their time underwater. Scientists are not sure why elephant seals are able to accomplish this, but they suspect that at such great depths elephant seals have almost no competition for their food. They are also safer from their primary nonhuman predator, the great white shark. Scientists are not absolutely certain about what elephant seals eat, but it is likely that they feed on octopus, squid, rays, hake, salmon, and rockfish.

Name _____ Date _____

Activity Sheet

Elephant Seal Adaptation Cards

J

Elephant Seal Adaptation:

Vocalizations

The sounds made by elephant seals are distinctive, meaningful, and play a role in their social order. Males rear up, throw back their heads, open their mouths wide and trumpet to advertise challenges and threats. Females use different sounds to discourage unwanted suitors and to warn other females away from their pups. Each mother and pup have special vocalizations that are instantly recognized by each other. These help to keep the female and pup together during the first week of nursing. Scientists have determined that different colonies even have different dialects.

K

Elephant Seal Adaptation:

Molting

All mammals lose and replace their hair. For example, dogs and humans shed their hair. Similarly, elephant seals molt. Once a year elephant seals lose and replace all their hair over a period of just a few weeks. They slough off their fur in patches and this is called a radical molt. This process reduces insulation, due to hair loss, and requires increased blood flow to the skin's surface in order to supply nutrients to the newly growing hair. Because heat loss occurs more rapidly in water than on land, elephant seals haul out onto beaches while the radical molt occurs.

L

Elephant Seal Adaptation:

Black Pup Fur

Pups are born with soft, black fur attached to skin that is extremely loose and wrinkled. A newborn has no blubber, but gains weight very rapidly, nursing on milk that is up to 50 percent fat (human mother's milk is 4 percent fat). Until the pup has accumulated blubber, its black fur, which absorbs heat, helps the pup keep warm. The black coat begins to molt within 3 to 4 weeks, and is replaced by silvery-tan hairs, in a process that takes 2 to 3 weeks to complete.

Name _____ Date _____

Activity Sheet

Elephant Seal Adaptation Cards

M

Elephant Seal Adaptation:

Sleep Apnea/ Breath Holding

Elephant seals' nostrils have the ability to remain closed when the animal is at rest. This allows the seal to sleep at sea without drowning. It also means the animal is not breathing while sleeping (sleep apnea). Upon waking, the nostrils must be snorted open. The apnea duration varies according to age, but can last between 4 and 10 minutes. Sleep apnea is a great strategy for conserving energy and water loss while on land.

N

Elephant Seal Adaptation:

Locomotion

The flippers of seals are different from those of sea lions, and therefore they move differently on land and in the ocean. Seals have shorter front flippers they hold close to their bodies as they swim, using powerful hip muscles and their rear flippers to propel them. Seals cannot rotate their rear flippers forward under their bodies. When moving on land they move with their front flippers and heave their bodies forward, undulating like an inchworm. Their rear flippers drag uselessly behind. Because they are not able to climb onto rocks, they haul out on low sloped, sandy beaches. When necessary, elephant seals can move very quickly for short distances.

O

Elephant Seal Adaptation:

Thermoregulation: Size Matters

Elephant seals are BIG. Males grow up to be 15 feet long and may weigh more than 5,000 pounds. Females grow to 9 feet long and weigh about one-third as much as adult males. Pups are 3 to 4 feet long and weigh 60 to 80 pounds at birth. Elephant seals' blubber accounts for much of their weight and is an adaptation to help them stay warm. The bigger an animal is, the less surface area (or skin exposed to the air) it has in relation to its volume, so it loses less heat.

Name _____ Date _____

Activity Sheet

Elephant Seal Adaptation
Thermoregulation: Size Matters

Elephant Seal Bull

13–18 feet

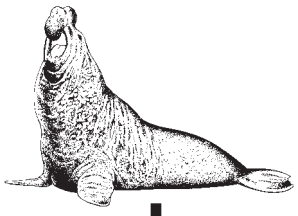
Elephant Seal Cow

8–10 feet

Elephant Seal Pup

3–4 feet

Who Is in the Elephant Seal's Food Pyramid?



Students will construct a food pyramid to lay a foundation for understanding the elephant seal life cycle and behaviors.

Time required: 90 minutes

Location: classroom

Suggested group size: entire class working in teams

Subject(s): science, art

Concept(s) covered: food pyramid, human ecology

Adapted from: MARE: Marine Activities, Resources and Education
Regents of the University of California

Written by: Heidi Strickfaden and Kim Linse, National Park Service

Last updated: 12/12/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand the elephant seals' role in a food pyramid.
- Understand human's role in every food pyramid.

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade	5a- food webs
	5b- matter is transferred from one organism to others in the food web
	7d- communicate the steps and results from an investigation
7th grade	7a- appropriate tools and technology to collect and display data
	7c- communicate logical connections

National Science Standard Links (grades 5–8)

This activity is linked to the national science standards in the following areas:

- Content Standard A – Use appropriate tools and techniques to gather, analyze, and interpret data
- Content Standard C – Populations and ecosystems, diversity and adaptations of organisms
- Content Standard F – Populations, resources, and environments

Materials

To be provided by the teacher:

- Art supplies for drawings
- Research materials: Field Guide to Pacific Coast Fishes (Peterson), Pacific Coast Field Guide (Audubon), Internet access, encyclopedia

To be photocopied from this guide:

- **Marine Food Pyramid** activity sheet

Vocabulary

diatom, food chain, food pyramid, habitat, krill, niche, primary producer, zooplankton, 1st–4th order consumer

Procedures

1. **Ecology Discussion**

   Lay the foundation for your lesson with the following background information:

   Just as we depend on community members such as doctors, police officers, and grocers to help support our daily activities, other living organisms depend on each other and various ecosystem functions for survival. Within natural communities, living organisms have a place to live (habitat) and a job (niche). Some living organisms are producers; others are consumers. Together with their varied niches, these living organisms form a balanced pyramid. This pyramid illustrates the flow of energy from one tier, or trophic level, to the next. As you move up the food pyramid, less biomass (or fewer organisms), is present at each trophic level than at the lower level. Organisms that are higher on the food pyramid generally require more biomass, or energy, from the lower levels for survival. If any one level becomes too large or too small, the pyramid can topple.

   Understanding the place that elephant seals hold in their food pyramid lays a foundation for understanding their life cycles and behaviors. In addition, understanding the connection between these various trophic levels allows us to understand the direct and indirect ways in which elephant seals are impacted by the health and abundance of organisms at these different trophic levels.

2. **Discussion of Food Pyramids**

   Start by discussing food pyramids. What is a food pyramid? What does it mean to be on the top of the food pyramid versus the bottom? Discuss individual organisms and their role as producers and consumers. Discuss differences between 1st–4th order consumers. If students are having difficulty understanding this concept use an example of a food pyramid from another organism (i.e. mountain lion, grizzly bear). Discuss differences between 1st–4th order consumers. Why is it important for us to understand food pyramids when studying elephant seals?

   Next discuss elephant seals and their role in the food pyramid. Who eats elephant seals? Who do elephant seals eat? What type of consumer are they? What is their habitat? What is their niche? Who do they have to compete with for survival? What do they do to avoid competition?

3. **Students Research Food Pyramid Organisms**
   Students work in groups and research organisms from the following list. Students will refer to previously gathered research material and the section of the elephant seal newspaper entitled "What Do Elephant Seals Eat?"

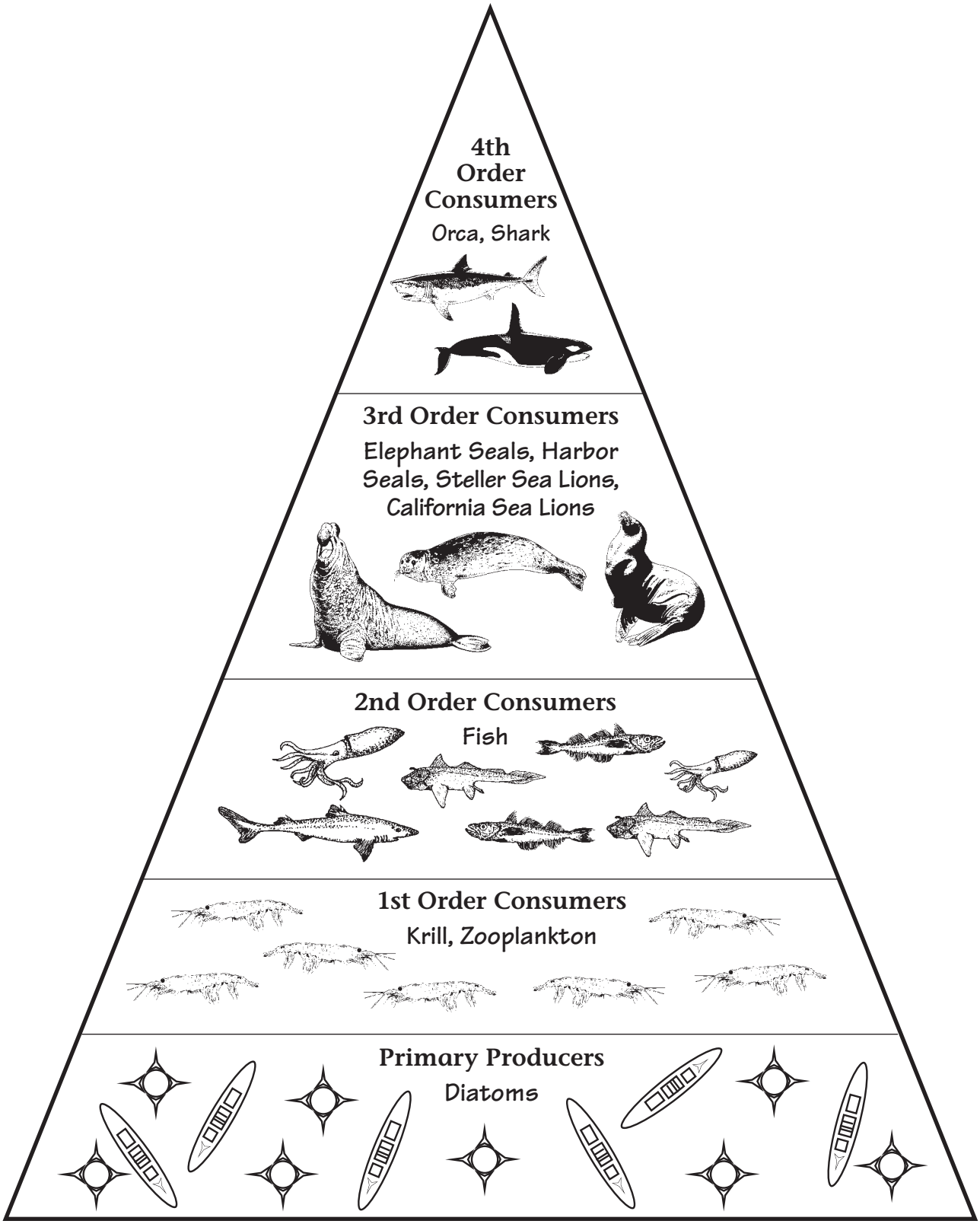
white shark	orca	elephant seal	harbor seal
steller sea lion	California sea lion	fish	squid
octopus	dogfish	Pacific hake	skate
ray	smaller shark	bottom	fish ratfish
rockfish	krill	zooplankton	diatom

   Students' reports should include a picture of their organism and answer the following questions:
   1. What is your organism?
   2. List three characteristics that describe your organism.
   3. Where does it live? what depth? what temperatures?
   4. What does it eat (prey)?
   5. What eats it (predator)?
   6. Where is your organism's place in the food pyramid?
4. **Students Create a Food Pyramid**
   Either on the chalkboard, or on a large piece of poster paper, create a blank food pyramid for the class. Use the **Marine Food Pyramid** activity sheet as a model. Starting with primary producers, have students assemble their pictures in the appropriate tiers of the pyramid and give a brief description of their organism. As other reports are presented, string or chalk can be used to draw in food chains as they are mentioned. Once the master food pyramid is complete, students should transcribe the information onto their blank individual **Marine Food Pyramid** activity sheet.
5. **Discussion of Human Impacts**
   When pyramid construction is complete, begin discussion of humans' impact on food pyramids. Where do humans fit into this food chain? Are human populations balanced with their position in the food chain (i.e., higher order consumers usually have lower population numbers because of their large territory sizes)? How could human impacts on the different trophic levels impact elephant seals?

Extension ideas

1. Reconstruct pyramid as a hanging mobile or mural.
2. Draw a food pyramid that includes humans/ human impacts.
3. Write a story about a year in the life of an elephant seal. Write from the perspective of a mature cow, bull, weaner, or newborn pup. Refer to the elephant seal newspaper to review lifecycle information. Include diet, adaptations, successes and challenges.

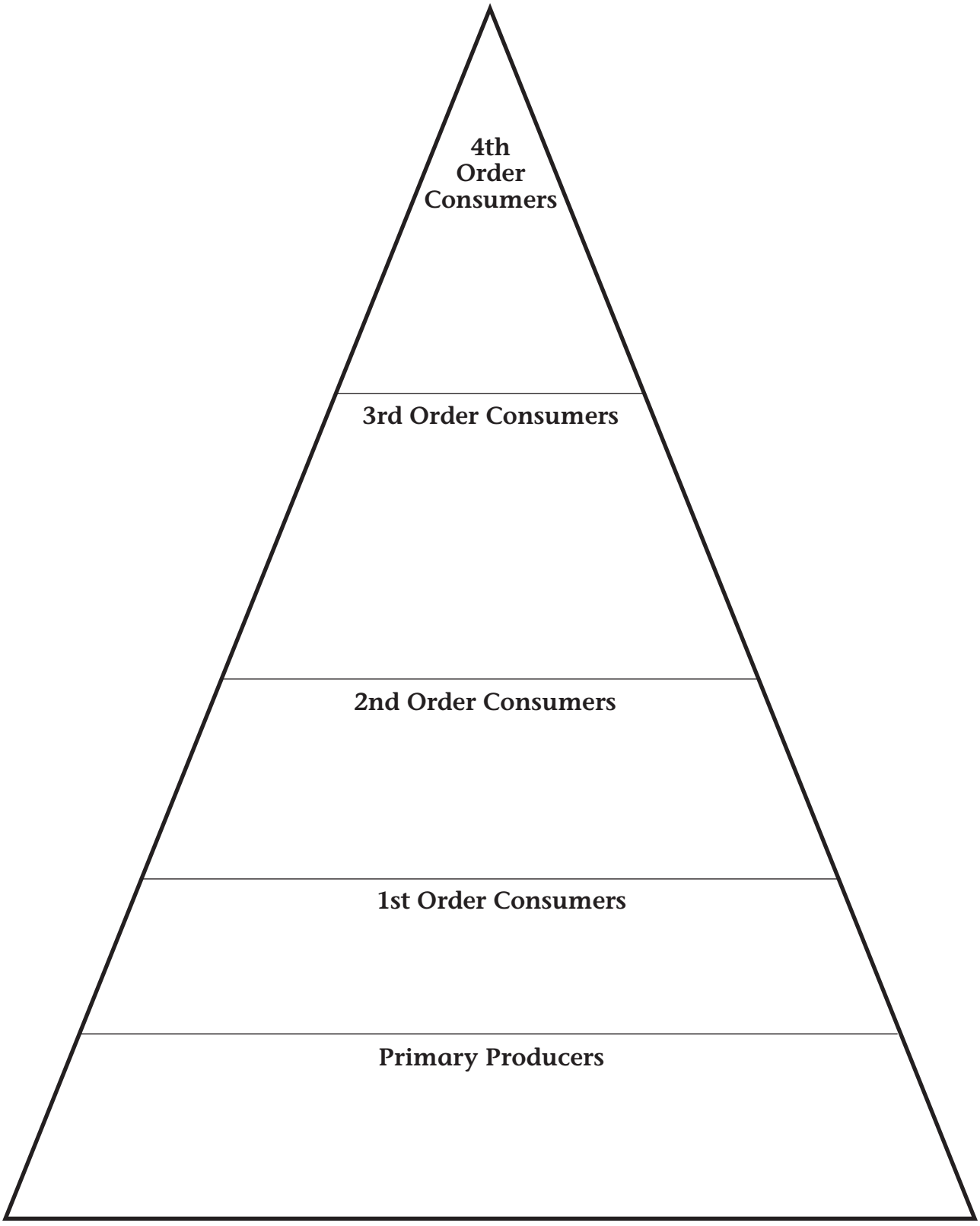
Marine Food Pyramid



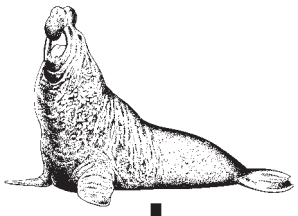
Marine Food Pyramid

Activity Sheet

Use this page to construct a food pyramid for elephant seals. If time allows, draw pictures of the organisms.



What Can We Expect On Our Field Trip to Observe Elephant Seals?



Students will prepare for upcoming field visit by constructing and reviewing personal field journal expectations. It is imperative that students become familiar with their field journals prior to their visit to insure a focused and satisfying experience.

Time required: 1 hour

Location: classroom

Suggested group size: all

Subject(s): science, math, writing

Concept(s) covered: elephant seal identification and behaviors

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 12/05/00

Student Outcomes

At the end of this activity, the students will be able to:

- Utilize field journals while viewing elephant seals.

California Science Standards Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5e- the number and types of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition
- 7b- appropriate tools and technology to perform tests, collect/display data
- 7h- identify changes in natural phenomenon over time without manipulation the phenomenon (e.g., a tree limb, a grove of trees, a stream, a hill slope)

7th grade
- 7a- appropriate tolls and technology to perform tests, collect and display data

8th grade
- 9b- evaluate the accuracy and reproducibility of data

Pre-Visit Lesson Plan

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A – Use appropriate tools and techniques to gather, analyze, and interpret data; understanding about scientific inquiry.
- Content Standard G – Science as a human endeavor; nature of science: students formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models

Materials

To be photocopied from this guide:

- Field journals for each student and chaperone (located in first onsite lesson plan)
  (NOTE: there are four journal sheets that need to be copied twice for each journal: Field Census, Behavior Survey, Behavior Field Notes, and Habitat Survey. All other journal sheets only need to be copied once for each journal.)
- Optional journal sheets (see on-site lesson "How Can I Capture My Experience in a Poem or a Drawing?")

Available for checkout at Bear Valley Visitor Center or use at Clem Miller:

- Elephant Seal Kit

Vocabulary

carrying capacity, habitat, subadult, weaner

Procedures

1. **Construct Field Journals**
   Have the students construct their field journals. See the attached sheet for **Tips for Constructing Field Journals**. Hand out photocopies of field journal sheets and have students assemble their field journals.

   Journals should be in the following order:
   Things to Remember while on Elephant Seal Field Trip
   Field Identification of Elephant Seals
   Elephant Seal Overlook Observation Sheet
   Lifeboat Station Observation Sheet
   Field Census (for Elephant Seal Overlook)
   Behavior Survey (for Elephant Seal Overlook)
   Behavior Field Notes (for Elephant Seal Overlook)
   Habitat Survey (for Elephant Seal Overlook)
   Lifeboat Station Observation Sheet
   Field Census (for Lifeboat Station)
   Behavior Survey (for Lifeboat Station)
   Behavior Field Notes (for Lifeboat Station)
   Habitat Survey (for Lifeboat Station)
   Scar Card
   Tagging and Marking of Pinnipeds
   Tag Colors and Locations
   Other Marine Species Sighting Log
   Vocabulary

2. **Review Field Trip Logistics**
   Upon arrival at Point Reyes National Seashore one group will travel to Elephant Seal Overlook and the other to Historic Lifeboat Station. After a predetermined amount of time, the two groups will switch locations. The on-site lesson explains this in more detail.
3. **Review Field Journals**
   Once journals are completed, review field activities by having students turn to appropriate pages in their journals as you review expectations and directions. Students should also record their names and school name at the top of each sheet.

   - **Things to Remember while on Elephant Seal Field Trip**
     This sheet will be used as part of the next lesson Safety and Stewardship Challenge.
   - **Field Identification of Elephant Seals**
     Review the different ages and sexes of elephant seals prior to field trip so students will be able to tell individuals apart. (Males have long noses and a dark round opening on their belly that looks like a "belly button." This is the penile opening.)
   - **Elephant Seal Overlook Observation Sheet**
     Students will be standing at the Elephant Seal Overlook to complete this sheet along with Field Census, Behavior Survey, Behavior Field Notes, and Habitat Survey. Students will be marking the locations of elephant seals along the map and noting presence of alpha males or pups.
   - **Lifeboat Station Observation Sheet**
     Students will be standing at the end of the pavement behind the Lifeboat Station to complete this sheet along with Field Census, Behavior Survey, Behavior Field Notes, and Habitat Survey. Students will be marking the locations of elephant seals along the map and noting presence of alpha males or pups.
   - **Field Census**
     A field census will be completed at both locations: Elephant Seal Overlook and Lifeboat Station. Students should start with the first column differentiating "Over one year old", "Under one year old", and "Visitors". A check mark or number should be placed in the boxes to indicate number observed. Once students complete the first column, they may then differentiate the "Over one year old" into males and females in the second column. Each column gets more difficult to differentiate, as some students may then be able to break the males into alphas and subadults.
   - **Behavior Survey**
     A behavior survey will be completed at both locations, Elephant Seal Overlook and Lifeboat Station. Students should observe elephant seals for a predetermined amount of time and place check marks in the appropriate column.
   - **Behavior Field Notes**
     A behavior field notes sheet will be completed at both locations, Elephant Seal Overlook and Lifeboat Station. Students should observe elephant seals for a predetermined amount of time and describe three behaviors observed in narrative format.

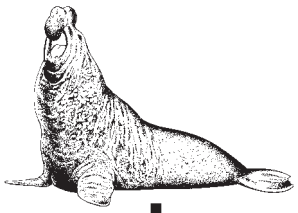
- **Habitat Survey**
  A habitat survey will be completed at both locations, Elephant Seal Overlook and Lifeboat Station. Students should fill out information and answer questions to the best of their ability.
- **Scar Card**
  If students notice an individual elephant seal that stands out because of unusual markings, scars, shark bites, or other wounds, they should record their observations on this sheet. Instruct students to draw what they see in the right location on the seals' body.
- **Tagging and Marking of Pinnipeds**
  If students notice that some seals or sea lions have tags or other research devices on their body, instruct students to record their observations on this sheet. If students can read the numbers on the tags, they should record that information and report it to the Seashore.
- **Tag Colors and Locations**
  If students notice the color of a tag or other research tool, this chart will indicate at which location the seal or sea lion was tagged.
- **Other Marine Species Sighting Log**
  If students see other marine species, such as other pinnipeds, birds, or whales, their observations may be recorded here. Field guides in the teacher backpack (which may be checked out from Bear Valley Visitor Center) will aid in identification.
- **Vocabulary**
  Students should note any words and/or definitions they may forget while on field trip. This last sheet will then serve as a reference guide.

4. **Field trip preparation**
   Review list of what students should bring on field visit.

Extension ideas

1. Research other laws written to protect mammals, plants and amphibians in Point Reyes National Seashore, California, and the United States. What happens if a protected animal leaves the area affording protection?
2. Research the role of a marine biologist. What is done with information biologists collect in the field, and how does it help the organism being studied?
3. Have students assume the role of aliens coming to study humans and their pets. What type of field journal would they need?

Tips for Creating Field Journals



Materials

- ❑ Field Journal Sheets for each student, teacher, and chaperone
- ❑ One package blank paper and one package lined paper
- ❑ colored paper, card stock, or cardboard for journal covers
- ❑ magic markers or colored pencils for decorating covers
- ❑ 3-hole punch
- ❑ string, binding tape, or twigs and rubber bands for binding
- ❑ pencil on a string for each student
- ❑ two plastic pencil sharpeners and extra pencils for field trip
- ❑ one box of large ziplock bags to rainproof journals

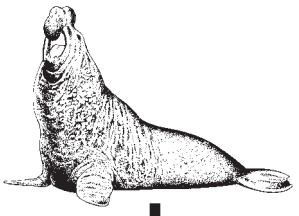
Procedures

1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or twigs bound by rubber bands threaded through holes. If they do not bind their journals, it is essential that students use a clipboard on the field trip.
5. Once journals are bound, have them decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have students use magic markers to write their names on the front covers of their journals.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension ideas

1. Create a journal that is used throughout the year.
2. Share student journals with parents at open houses and/or to educate others.
3. Students may choose to use their journals to create a class newsletter, resource newspaper, or a class website.

Safety and Stewardship Challenge



Students will learn methods for observing elephant seals and understand proper behaviors in a National Park. This will be accomplished by simulating a group "game show" and completing the first page of their field journals.

Time required: 1 hour or more

Location: classroom

Suggested group size: any

Subject(s): science

Concept(s) covered: low impact use of natural areas, visitor behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service

Last updated: 05/21/00

Student Outcomes

At the end of this activity, the students will be able to:

- List three safety precautions for upcoming field trip.
- List three proper behaviors for viewing elephant seals.
- Understand the concepts of the National Park Service and stewardship.

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following area:

- Content Standard F – Personal health: injury prevention; populations, resources, and environment

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team can answer question first)

To be photocopied from this guide:

- **Challenge Questions** (one set)

Vocabulary

stewardship

Procedures

1. **Divide class into teams.**
   Option A: If class can work as large teams, divide the class into two teams. Each team will need a spokesperson and team name. Answers will come from the entire group. Spokesperson can change throughout the game.
   Option B: If class gets too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Randomly choose a number from hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.
2. **Draw Challenge Grid and Scorecard on blackboard**
   There are four categories with questions of varying value. As a finale, there is a final challenge question. Draw this grid on the chalkboard:

<table>
<tr><td colspan="4">Safety and Stewardship Challenge</td></tr>
<tr><td>Category #1
Take Care of Yourself</td><td>Category #2
Minimize Your Impact</td><td>Category #3
Elephant Seal Etiquette</td><td>Category #4
The National Park Service</td></tr>
<tr><td>1 point</td><td>1 point</td><td>1 point</td><td>1 point</td></tr>
<tr><td>2 points</td><td rowspan="2">2 points</td><td>2 points</td><td rowspan="2">2 points</td></tr>
<tr><td>3 points</td><td>3 points</td></tr>
<tr><td rowspan="2">4 points</td><td rowspan="2">3 points</td><td>4 points</td><td rowspan="2">3 points</td></tr>
<tr><td>5 points</td></tr>
<tr><td colspan="4">Final Challenge</td></tr>
</table>

3. **Choose Game Show Hosts**
   Option A: Teacher is responsible for asking all of the questions.
   Option B: Four students will become "Challenge Hosts". Each student receives questions for a specific category and will ask appropriate questions according to point value.

4. **Rules of the Game**
   - A coin flip will determine which team goes first.
   - The challenge will end when a predetermined time runs out or when all questions have been answered.
   - Team will decide which category and value of question will be asked.
   - Spokesperson or individuals will poise themselves on either side of the desk bell with one hand behind their back.
   - After the question is asked, the first team to have an answer will ring the bell and respond. If they are correct, the team receives the full point value.
   - If they are incorrect, the other team gets a chance. If they also get it wrong, the first team can try again for one less point.
   - When brainstorming answers, students should whisper, or the other team might hear their answers.
   - When all of the categories are complete (or 5 minutes before a predetermined "game-over" time), class will go into "Final Challenge". Each team decides on amount of wager, listens to question, and writes down answer on a sheet of paper. Each team will then reveal answer.
   - At the end of the challenge, the team with the most points "wins", but everyone wins if your visit to Point Reyes National Seashore will be safe for themselves and the resources.
5. **Complete first page of field journal:**
   Using the information gained in this "game show", have students list at least three items under each category on the first page of their journal ("Things to Remember While on Field Trip"). Use the **Safety Issues: Elephant Seal Unit** at the end of this lesson as a guide.

Safety and Stewardship Challenge Questions

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because . . .

A . . . you will not be able to speak well with a dry throat.

B ***. . . not drinking enough water can give you a headache and cause you to make bad decisions.***

C . . . a heavy water bottle will slow you down as you are walking.

D all of the above.

2 points

If the sun feels warm, you should . . .

A . . . try to get a tan.

B ***. . . use sunglasses, sunscreen, and/or a hat.***

C . . . take off your shoes and walk barefoot.

D all of the above.

3 points

Cliff edges in Point Reyes National Seashore are . . .

A . . . made of granite and are safe as long as you have one foot flat on the ground at all times.

B ***. . . sandy, loose, and slippery; be careful at all times.***

C . . . safe if you have good balance.

D . . . the best places for a good view.

4 points

The best way to dress for a field trip:

A comfortable closed-toed shoes.

B a T-shirt and a heavy, waterproof jacket.

C "like an onion"—many thin layers with a waterproof one on the outside.

D ***A and C.***

Safety and Stewardship Challenge Questions

CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because . . .

A . . . you are more likely to pick up a tick in grassy areas.

B . . . you can damage plants.

C . . . when you travel off-trail you are speeding up erosion.

D ***All of the above.***

2 points

It's okay to take home just one rock from Point Reyes National Seashore.

A Sure; it's just one, but let your teacher know.

B No; every rock is home to many bugs and plants.

C No; with 2.5 million visitors, the Seashore would be rockless if every visitor collected just one.

D ***B and C.***

3 points

Trash is . . .

A . . . okay to hide behind bushes in a National Park because it will eventually break down.

B . . . not a good source of food for hungry animals.

C ***. . . not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's your trash, or trash that someone else has left behind.***

D . . . only the responsibility of the maintenance staff, wherever it is.

Safety and Stewardship Challenge Questions

CATEGORY #3: Elephant Seal Etiquette

1 point

If an elephant seal is close, you should try to . . .

A . . . feed it some of your lunch.

B ***. . . leave it alone, if it reacts to your presence in any way, you are disturbing the seal and breaking the law.***

C . . . make alpha bull noises so it will look your way.

D . . . yell really loud to your entire group so everyone sees it, even if it may scare the elephant seal away.

2 points

Stay at least . . .

A 1 foot from a marine mammal.

B 10 feet from a marine mammal.

C ***100 feet from a marine mammal.***

D Get as close as you can.

3 points

The best way to observe elephant seals is to . . .

A watch quietly from a safe distance of at least 100 feet.

B whisper.

C move slowly.

D ***all of the above***

4 points

Feeding wildlife will . . .

A . . . bring them closer for a good look and great photo.

B . . . put you in danger of being bitten.

C . . . accustom them to humans and possibly create behaviors harmful to the animal's survival.

D ***B and C above.***

5 points

If you come across wildlife appearing sick or injured, you should . . .

A try to capture the animal and seek medical attention.

B ***report the location, species, and your observations to someone responsible for its management (Park Rangers in National Parks, Humane Society in urban areas).***

C harass it to see just how sick it really is.

D get as close as possible to observe what is happening.

Safety and Stewardship Challenge Questions

CATEGORY #4: The National Park Service

1 point

Which of the following is not in the National Park Service?

A Grand Canyon National Park, AZ.

B Keweenaw National Historical Park, MI.

C ***Monterey Bay Aquarium, CA.***

D Golden Gate National Recreation Area, CA.

E Yosemite National Park, CA.

2 points

I should treat Point Reyes National Seashore with respect because . . .

A . . . it belongs to everyone in the entire United States.

B . . . it preserves a part of the ecosystem you live in and depend on.

C . . . it's one of the few places natural processes can happen with little intervention from human society.

D ***all of the above.***

3 points

Which of the following is the mission of the National Park Service?

A preserve natural and cultural resources.

B provide for the enjoyment, education, and inspiration of this generation.

C to care for special places saved by the American people so that all may experience our heritage.

D cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.

E ***all of the above.***

FINAL CHALLENGE

This question is worth the amount that each team agrees to wager.

What does stewardship mean?

Teacher is the final judge on this answer.

Safety Issues: Elephant Seal Unit

Personal Safety

- Watch where you are walking; the ground may be rocky, slippery, and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays; use sunscreen and/or a hat.
- Stay on paths and in picnic areas. Grassy areas may have ticks known to transmit Lyme disease.
- Be aware of personal allergies or conditions that may cause concern on the trail.

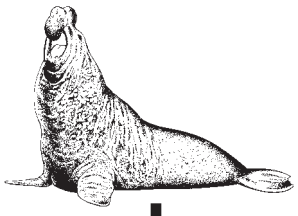
Elephant Seal Watching Tips

- For your own safety, always observe elephant seals from a distance.
- Use binoculars and spotting scopes. If a seal becomes alert or nervous and begins to move away, you are too close.
- Stay at least 100 feet from any marine mammal.
- Do not come between a cow and pup, a bull and a group of cows, or two bulls challenging each other.
- Watch quietly and whisper. Move slowly.

Remember: You are in a part of the National Park System

- Point Reyes National Seashore is a natural area set aside to protect living and nonliving components of ecosystems. Treat everything with respect.
- Allow plants and rocks and everything to continue their existence as part of an ecosystem: leave things as they are found.
- Stay on established trails, pack out trash or use garbage cans.
- Enjoy your visit and know this is your National Seashore!

How Do I Use Binoculars?



Being able to clearly see elephant seals is vital to the success of your students' field trip. Students prepare for upcoming field trip by becoming familiar with binocular structure and use.

Time required: time varies

Location: in class and/or sections at Bear Valley Visitor Center

Suggested group size: entire class

Subject(s): physics

Concept(s) covered: binocular structure and use

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 09/31/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand the structure of binoculars.
- Practice focusing on moving images with binoculars

California Science Standard Links (grades 6–8)

This activity is linked to the California Science Standards in the following areas:

6th grade: 7b- appropriate tools/technology to perform tests, collect/display data

7th grade: 6b- to see an object, light emitted/scattered must enter eyes
6d- simple lenses used in optics
7a- appropriate tools/technology to perform tests, collect/display data

National Science Standard Links (grades 5–8)

This activity is linked to the National Science Standards in the following area:

- Content Standard A – Abilities necessary to do scientific inquiry: use appropriate tools and techniques to gather, analyze, and interpret data.

Materials

To be provided by the teacher:

- 1–15 pairs of binoculars

Available for checkout at Bear Valley Visitor Center or use at Clem Miller:

- Elephant Seal Kit

Procedures

Note: This lesson can be done in various stages depending on whether or not students have access to binoculars in class.

- If students can ***bring in a pair*** of binoculars to use in class:
  This entire lesson can be conducted in class.
- If students can ***share a pair*** of binoculars to use in class:
  Procedure 1 and 2 taught to entire class. Student teams can experiment with binoculars in 10-minute intervals throughout day.
- If students ***do not have access*** to binoculars:
  Procedures 1 and 2 can be conducted in class, Procedure 3 at Bear Valley Visitor Center when students receive individual binoculars from the Elephant Seal Kit.

1. How do binoculars work?

In Theory: Before prisms were available, lens barrels had to be very long to increase the distance between eyepiece lens and objective lens to achieve magnification. These are the traditional "pirate scopes". With the introduction of prisms, the light could be bent and barrels made shorter. Binocular vision allows two images to become one for depth perception. Monoculars are like binoculars, but made for one eye and provide no depth perception.

In Structure: There are four main components of binoculars. Power is a function of these components. A 6 × 30 binocular has 6× magnification and a 30-millimeter lens. A larger lens lets in more light.

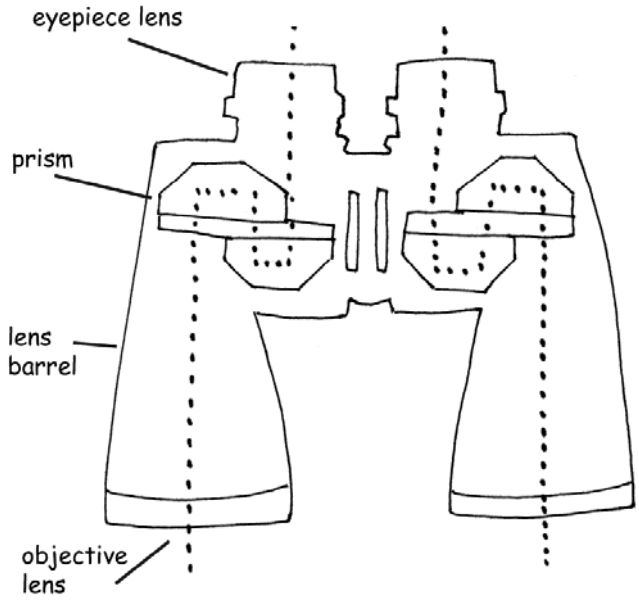
Eyepiece lens: there are several convex lenses here for magnification. This is the lens closest to your eyes.

Prism: Bends light rays and returns reverse image to normal.

Lens barrel: Keeps distance between eyepiece lens and objective lens; blocks side lighting and protects from dirt.

Objective lens: Gathers light in a convex lens. This is the lens that has a millimeter measurement (i.e., 6 × 30).

Diagram of Binocular Design



2. **How do I get binoculars to work specifically for me?**
   Taking care of binoculars:
   - Always keep them attached around your neck so they aren't accidentally dropped.
   - While you are focusing binoculars, stand still. It would be easy to fall while focusing and walking.
   - Clean binoculars properly.

   If you wear eyeglasses:
   - Keep your eyeglasses on.
   - There is usually an "eye cup" rubber piece that folds back where your eyeglasses meet the eyepiece lens.

   Things you adjust once:
   - Barrel distance: The two barrels can be moved closer or further apart depending on the distance between you eyes.
   - Right eyepiece focus: There is a knob on the right eye piece that corrects for visual differences between your two eyes. If you are seeing more than one image, adjust the right eyepiece until there is one image.

   Things you need to adjust with each observation:
   - Center focus: Adjust the center focus with each observation to bring image into view.

   Focusing on an image:
   - Adjust barrel distance and right eyepiece
   - Locate the image with your eyes. Are there any landmarks or reference points next to the image? These may help you find the image using the binoculars.

- Focus your eyes on the image. Without looking down, place the binoculars directly in front of your eyes. The rubber cup surrounding the eyepiece lens should rest against your eyebrow (unless you are wearing eyeglasses).
- Focus image into view with center focus.
- Keep elbows tucked in close to your body and both hands on binoculars to avoid a shaky image.

3. **Practice using binoculars.**

Focus on a stationary object.
Pick an object that doesn't move. Choose one near and one more distant. Use center focus.

Focus on moving objects in class.
Right/left: Have a student walk slowly across the classroom while students use binoculars to keep in view. Speed up student walker to add a challenge.

Away/toward: Choose a student to move toward and away binoculars. Discuss range that binoculars will work. At some point, the object is too close to focus.

Focus on multiple moving objects at school.
Attend a sporting event or practice at a lunch session in the cafeteria. Place a wildlife poster on a piece of cardboard and stick. Have a student move around the classroom with the posterboard: slow, fast, up, down, toward, away.

Focus on wildlife.
Bring class outside in an area where they are likely to view moving wildlife such as birds.